Vacuum Solutions | Application Support | Service

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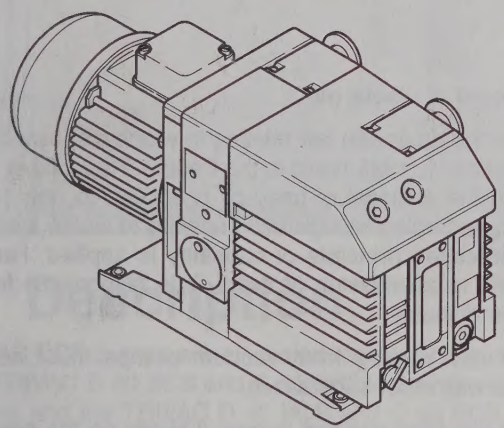
LEYBOLD VACUUM

GA 01.301/5.02



TRIVAC® BCS

Rotary Vane Vacuum Pump S/D 40 BCS, S/D 65 BCS

Cat. No.
103 88/89/98/99
113 88/89/98/97/99

MP MASTER
MA29106

Operating Instructions

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Warning Indicates procedures that must be strictly observed to prevent hazards to persons.

Caution Indicates procedures that must strictly be observed to prevent damage to, or destruction of the equipment.

Leybold Service

If a pump is returned to Leybold, indicate whether the pump is free of substances damaging to health or whether it is contaminated.

If it is contaminated also indicate the nature of the hazard. Leybold must return any pumps without a "Declaration of Contamination" to the sender's address.

Disposal of waste oil

Under the amended law relating to waste disposal dated November 1, 1986 (valid in the Federal Republic of Germany) the disposal of used oil is subject to new provisions. According to legislation relating to waste disposal the so-called principle of causality is applied. Hence, anyone in possession of used oil is responsible for its proper disposal.

Used oils coming from vacuum pumps must not be mixed with other substances.

Used oils from vacuum pumps (LH-oils on the basis of mineral oils) having been affected by normal contamination due to oxygen from the ambient air, increases in temperature and mechanical wear, must be disposed of as used oil in accordance with the regulations.

Used oils from vacuum pumps that have been contaminated by other substances must be labelled, stored and disposed of as special waste with reference to the kind of contamination.

When disposing of used oil please observe the safety regulations that are valid in your country.

In many countries proof of were the oil has finally been left is required by Law and often shipping of such contaminated waste requires permission by the authorities. Waste disposal information is available through:

Bundesamt für Gewerbliche Wirtschaft (BAW)
Frankfurter Str. 29-31
D-65760 Eschborn/Taunus
Tel.: ++49 (0)6196 40 41 - Fax:: ++49(0)6196 40 42 12

We reserve the right to modify the design and the specified data. The illustrations are not binding.

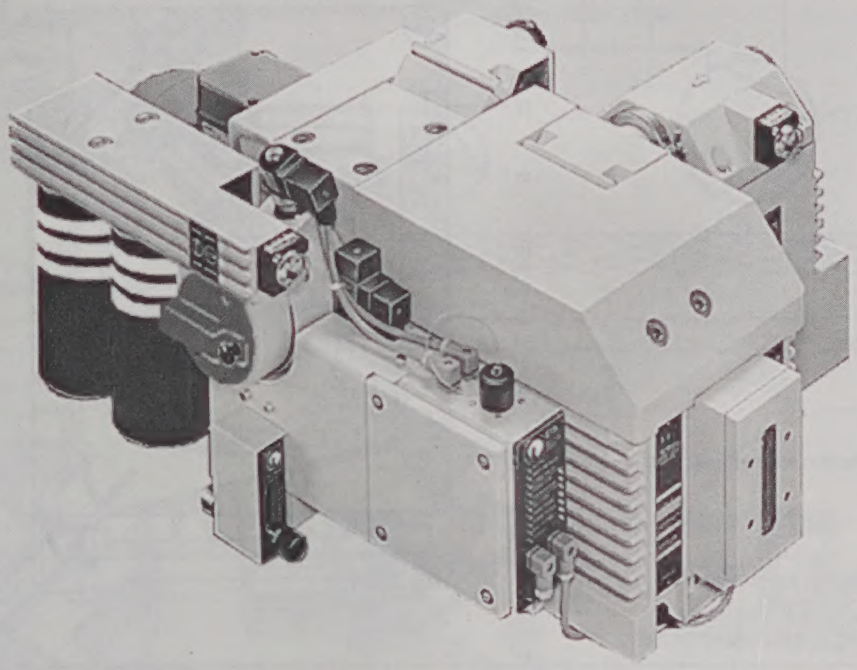


Fig. 1 TRIVAC BCS pump with accessories

1 Description

TRIVAC BCS pumps are oil-sealed rotary vane pumps. The TRIVAC S 40 BCS and S 65 BCS are single-stage pumps, and the TRIVAC D 40 BCS and D 65 BCS are dual-stage pumps. The number in the type designation (40 or 65) indicates the pumping speed in $m^3 \cdot h^{-1}$.

The TRIVAC BCS-PFPE have been prepared especially for operation with perfluoropolyther.

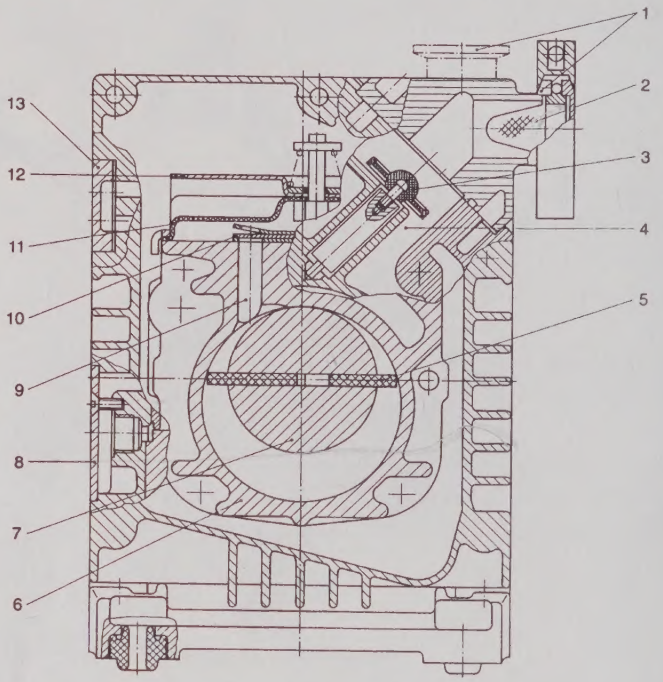
TRIVAC BCS pumps can pump gases and vapours, and evacuate vessels or vacuum systems in the fine vacuum range.

They have been designed particularly for use in connection with corrosive or aggressive media. Moreover, the pump has been prepared for the installation of an electric monitoring facility. Leybold have developed for the TRIVAC BCS a range of accessories which considerably extend the range of applications for this kind of pump. These accessories which in connection with the TRIVAC BCS vacuum pump make up the TRIVAC system, are described briefly in Chapter 1.6.

The drive motor of the TRIVAC BCS is directly flanged to the pump at the coupling housing. The pump and motor shafts are directly connected by a flexible coupling. The bearing points of the pump module are force lubricated sliding bearings. All controls as well as the oil-level glass and the nameplate are arranged on the front. All connections are to be found at the sides of the pump. The oil-level glass is provided with prisms for better observation of the oil level.

The pump module consists of assembly parts which are pin-fitted so as to allow easy disassembly and reassembly. The pump module can be easily removed without special tools.

Warning Those of standard design are **not** suitable for pumping greater than atmospheric concentrations of oxygen.



Key to Fig. 2

1 Intake port
2 Dirt trap
3 Anti-suckback valve
4 Intake channel
5 Vanes
6 Pump chamber
7 Rotor
8 Cover plate, connection for inert gas ballast
9 Exhaust channel
10 Exhaust valve
11 Internal demister
12 Spring buckles
13 Cover plate, connection for oil filter

Fig. 2 Sectional drawing of the TRIVAC BCS

1.1 Function

The rotor (2/7), mounted eccentrically in the pump housing (2/6), has two radially sliding vanes (2/5) which divide the pump chamber into several compartments. The volume of each compartment changes periodically with the rotation of the rotor.

As a result, gas is sucked in at the intake port (2/1). The gas passes through the dirt trap sieve (2/2), flows past the open anti-suckback valve (2/3) and then enters the pump chamber. In the pump chamber, the gas is passed on and compressed, after the inlet aperture is closed by the vane.

The oil injected into the pump chamber is used for sealing and lubricating. The slap noise of the oil in the pump which usually occurs when attaining the ultimate pressure is prevented by admitting a very small amount of air into the pump chamber.

The compressed gas in the pump chamber is ejected through the exhaust valve (2/10). The oil entrained in the gas is coarsely trapped in the internal demister (2/11); there the oil is also freed of mechanical impurities. The TRIVAC BCS PFPE pumps do not have an internal demister. The gas leaves the TRIVAC BCS-PFPE through the exhaust port.

During compression, a controlled amount of air – the so-called gas ballast – can be allowed to enter the pump chamber by opening the gas ballast valve. The gas ballast stops condensation of vapours in the pump chamber up to the limit of the water vapour tolerance as specified in the technical data for the pump.

The gas ballast valve is opened and closed by turning the gas ballast knob (7/5) on the front.

The gas ballast facility of the TRIVAC BCS pump has been prepared for connecting the inert gas system IGS, see Chapter 1.6.2.

To enable the TRIVAC BCS to be used at intake pressures as high as 1,000 mbar, a special lubricating system was developed featuring force-lubrication of the sliding bearings.

An oil pump (3/6) pumps the oil from the oil reservoir (3/5) into a pressure-lubrication system which supplies oil to all bearing points (3/2). From there the oil enters the pump chamber area (3/4) of the vacuum pump.

The oil pump is fitted in the front end plate on the coupling side of the pump module. The oil suction line is placed low, resulting in a large usable oil reservoir.

The oil is separated from the gas in the TRIVAC BCS in two steps as described above. First, small droplets are coalesced into large drops in the internal demister (2/11) fitted above the exhaust valve (2/10). Then, the large drops fall into the oil reservoir as the exhaust gas is diverted by the inner walls of the oil case. Thus a low loss of oil is obtained. This and the large usable oil reservoir ensure long intervals between oil changes even at high intake pressures.

Key to Fig. 3
1 Accessories
2 Bearings
3 Non-return valve
4 Pump chamber of the TRIVAC
5 Oil reservoir
6 Oil pump

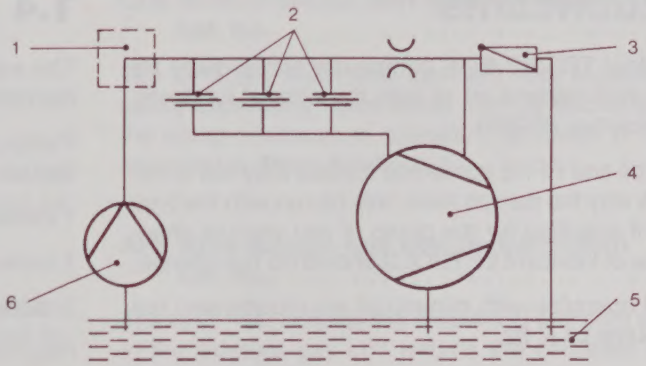
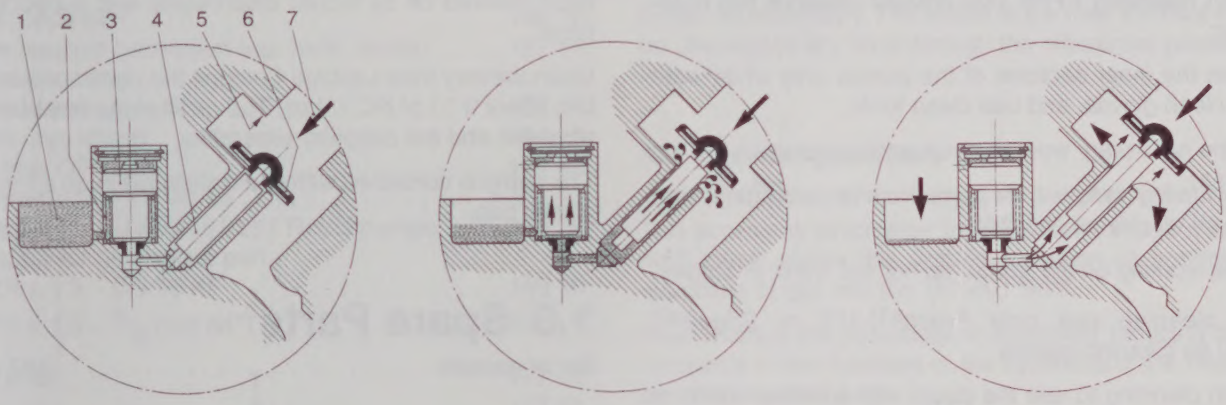


Fig. 3 Schematic of the lubricating system



Key to Fig. 4
1 Oil reservoir
2 Spring
3 Control piston
4 Anti-suckback piston
5 Valve seat
6 Valve disk
7 Gas inlet

Fig. 4 Hydropneumatic anti-suckback valve

The vacuum is maintained by the TRIVAC BCS through an integrated hydropneumatic anti-suckback valve (2/3) which is controlled via the oil pressure.

During operation of the TRIVAC BCS the control piston (4/3) remains sealed against a spring (4/2) by the oil pressure. The valve disc (4/6) of the anti-suckback valve is held at the lower position by its own weight (valve open). When the pump stops (because it has been switched off or because of a failure), the oil pressure drops and the spring (4/2) presses the control piston (4/3) up. Thus a connection is provided between the oil case or the oil reservoir (4/1) and the piston (4/4) of the anti-suckback valve.

Due to the pressure difference between the oil case and the intake port the oil presses the piston (4/4) up and the valve plate (4/6) against the valve seat (4/5). The quantity of oil in the oil reservoir (4/1) prevents the entry of air into the intake port (2/1) at the beginning of this process.

After the oil has flowed out from the reservoir and when the valve plate rests on the valve seat, air follows in, which vents the pump chamber and forces the valve disc (4/6) against its seat.This effectively prevents backstreaming of oil or oil vapours. The anti-suckback valve (2/3) operates independently of the operating mode of the pump, i.e. also with gas ballast.

All aluminium surfaces of the TRIVAC BCS are surface protected and thus particularly capable of resisting aggressive chemicals. A thermocouple has been incorporated in the pump which is used in connection with the optional electrical monitoring facility. The thermocouple may be accessed through the built-in connector (7/8).

Via a second oil fill opening, an exhaust line may be connected for venting the oil case when using the inert gas purging facility.

1.2 Lubricants

The standard TRIVAC BCS pumps are either ready for operation with mineral oil or with the special lubricant, perfluoropolyther (PFPE).

If mineral oil and PFPE come into contact they will emulsify. That's why the pumps must only be run with the type of lubricant specified for the pump. If you want to change the type of lubricant LEYBOLD should do the change.

In case of operation with mineral oil we recommend our vacuum pump oil N 62.

In case of operation with PFPE we recommend our vacuum pump oil NC 1/4.

When handling PFPE you should observe the following:

Touch the inner sections of the pumps only while wearing clean gloves, and use clean tools;

Do the necessary work in clean and dry rooms;

After having removed the pump from its packaging, start it up as quickly as possible;

While working on the pump, do not eat, drink or smoke.

For cleaning use only Freon®1)-113 or Frigen®2) -113) as cleaning agents.

When planning to use the pump with a different kind of lubricant contact us first.

The Operating Instructions GA 07.009 „PFPE for Vacuum Pumps" will be enclosed with all TRIVAC BCS pumps. Observe the handling notes for PFPE collected in these Operating Instructions.

Given in Operating Instructions GA 07.009 are also the deviating specifications which apply to TRIVAC BCS pumps operated with PFPE.

®1) Registered Trade Mark of Du Pont de Nemours
®2) Registered Trade Mark of Farbwerke Hoechst AG

1.3 Transportation

Warning

- Pumps which are filled with operating agents must only be moved while standing upright. Otherwise oil may escape. Avoid any other orientations during transport.
- Check the pump for the presence of any oil leaks, since there exists the danger that someone may slip on spilt oil.
- When lifting the pump you must make use of the crane eyes provided on the pump for this purpose; also use the recommended type of lifting device.

1.4 Supplied Equipment

The equipment supplied with the TRIVAC BCS pump for operation with mineral oil includes:

Pump with motor, including initial filling of N 62 or HE-200 oil,

1 centering ring,

1 centering ring with dirt trap,

2 clamping rings DN 40 KF.

Plug without cable to protect the socket for the temperature switch.

For protection during shipment, the connection ports are each blanked off by rubber diaphragms and supporting rings.

Upon delivery from Leybold Cologne the pumps will contain about 0.7 l of NC 1/4 oil. The oil fill plugs have been removed and are supplied separately.

The pump is contained with some silica gel in an air-tight plastic bag.

1.5 Spare Parts

Set of gaskets		197 42
Pump module, complete	S 40 BCS	200 39 759
	D 40 BCS	200 39 758
	S 65 BCS	200 39 761
	D 65 BCS	200 39 760
	S 40 BCS-PFPE	200 39 153
	D 40 BCS-PFPE	200 39 154
	S 65 BCS-PFPE	200 39 155
	D 65 BCS-PFPE	200 39 156
Module-gasket		239 73 039*)
Oil case gasket		200 09 148*)
Internal demister		390 26 014*)

*) included in gasket set

1.6 Accessories

1.6.1 Standard Accessories and Lubricants

Cat. No. / Ref. No.

Separator AK 40-65, DN 40 KF 188 16
Exhaust filter AF 40-65, DN 40 KF 189 16

Drain tap for condensate trap, exhaust filter oil drain of the pump,
vacuum-tight 188 91
oil-tight 188 90

Exhaust filter with lubricant return
AR 40-65, DN 40 KF 189 22
Dust filter 186 15
Dust separator 186 16
Fine vacuum adsorption trap (with zeolite) 187 15
Adsorption trap
(with aluminium oxide) 854 16
(with cryo insert) 854 19
Oil filter OF 40-65 . . . . . 101 92
Chemical filter CF 40-65 . . . . . 101 97
Adaptor for RUVAC 151/251 Roots pumps 168 30
Adaptor for gas ballast port
M 16 x 1.5 – DN 16 KF 168 40
M 16 x 1.5 – $^3/_8$ inch NPT 99 175 011*)

Oil N 62	1 l	177 01
	5 l	177 02
	20 l	177 03

(Order through Leybold Cologne, Germany)

NC 1/14	1 l	177 38
HE 1600	10 lb	898 564
HE 200	1 qt	98 198 006
HE 200	12 qt case	98 198 049
HE 200	1 gal	98 198 007
HE 200	5 gal	98 198 008

(Order oil HE 200 through LHVP, Export, Pa, USA)

Oil grades N 62 and HE 200 are equivalent.

Special oils upon request.

Caution Use only the kind of oil specified by Leybold. Alternative types of oil upon request.

1.6.2 TRIVAC System

Leybold has developed the TRIVAC system especially for processes which depend on the reliability of the pump under difficult conditions (pumping of aggressive gases or vapours, for example).

Moreover, the pump status may be monitored continuously through visual and electric indicators.

The TRIVAC system consists of the TRIVAC BCS pump and the following accessories:

CFS 40-65 chemical filter w. safety separating valve
Cat. No. 101 77

The CFS is a main flow lubricant filter incorporating a safety separating valve which may be exchanged while the pump continues to operate. The status of the interchangeable filters is indicated.

ARS 40-65 exhaust filter with lubricant return
Cat. No.: 189 57

The ARS filter collects the droplets of lubricant entrained in the exhaust gas and returns the collected lubricant back into the pump by means of a float controlled valve. This reduces the consumption of lubricant by the pump to an insignificant level so that a daily oil check will no longer be necessary. The status of the filter element may be checked at any time through the differential pressure indicator.

IGS 40-65 inert gas system
Cat. No.: 161 77

This accessory which may be controlled through a solenoid valve allows the definite injection of controlled quantities of gas into the TRIVAC BCS.

Thus it offers the possibility of effectively reducing contaminants in the lubricant of the system and the materials of the system itself.

LSS 40-65 limit switch system
Cat. No.: 161 07

This accessory consists of a package of limit switches and serves the purpose of monitoring the operation of the system.

Included with the limit switch system are one each:

- oil pressure switch (operating pressure)
- float switch (oil level monitoring)
- flow switch (inert gas)
- differential pressure switch (chemical filter)
- pressure switch (exhaust filter)
- connection cable for the built-in temperature switch

EIS 40-65 electrical indicator system
Cat. No.: 160 97

This accessory combines all switch status signals and indicates the status of these switches through LEDs: "GREEN" for normal operation, "RED" for fault. Through a multi-way connector all signals may be accessed for transmission to a remote processing unit.

1.7 Technical Data

TRIVAC BCS		S 40 BCS single-stage	D 40 BCS two-stage	S 65 BCS single-stage	D 65 BCS two-stage
Nominal pumping speed [1]	$m^3 \cdot h^{-1}$ (cfm)	46 (27.1)	46 (27.1)	75 (44.2)	75 (44.2)
Pumping speed [1]	$m^3 \cdot h^{-1}$ (cfm)	40 (23.6)	40 (23.6)	65 (38.3)	65 (38.3)
Ult. partial pr. without gas ballast [1]	mbar	-	10^{-4}	-	10^{-4}
	Torr	-	$0.75 \cdot 10^{-4}$	-	$0.75 \cdot 10^{-4}$
Ultimate total pr. without gas ballast [1]	mbar	$< 2.5 \cdot 10^{-2}$	$< 2 \cdot 10^{-3}$	$< 2.5 \cdot 10^{-2}$	$< 2 \cdot 10^{-3}$
	Torr	$< 1.9 \cdot 10^{-2}$	$< 1.5 \cdot 10^{-3}$	$< 1.9 \cdot 10^{-2}$	$< 1.5 \cdot 10^{-3}$
Ultimate total pr. with gas ballast [1]	mbar	$< 6.5 \cdot 10^{-1}$	$< 5 \cdot 10^{-3}$	$< 6.5 \cdot 10^{-1}$	$< 5 \cdot 10^{-3}$
	Torr	$< 4.9 \cdot 10^{-1}$	$< 3.8 \cdot 10^{-3}$	$< 4.9 \cdot 10^{-1}$	$< 3.8 \cdot 10^{-3}$
Water vapour tolerance [1]	mbar (Torr)	65 (48.8)	40 (30)	65 (48.8)	40 (30)
Oil filling, min./max.	l	2.0/3.7	1.7/2.6	2.5/3.3	2.0/3.3
Connections	DN	40 KF	40 KF	40 KF	40 KF
Motor protection	IP	54	54	54	54
Weight *	kg (lbs)	58 (127.9)	68 (149.9)	69 (152.1)	80 (176.4)
Motor power *	W	1500	1500	2200	2200
Noise level * to DIN 45 635 without/with gas ballast	dB (A)	57/59	57/59	57/59	57/59
TRIVAC BCS with three-phase motor					
230/400 V, 50 Hz / 250/440 V, 60 Hz		**Cat. No. 103 88**	**Cat. No. 113 88**	**Cat. No. 103 98**	**Cat. No. 113 98**

TRIVAC BCS-PFPE		S 40 BCS-PFPE single-stage	D 40 BCS-PFPE two-stage	S 65 BCS-PFPE single stage	D 65 BCS-PFPE two-stage
Nominal pumping speed [1]	$m^3 \cdot h^{-1}$ (cfm)	46 (27.1)	46 (27.1)	75 (44.2)	75 (44.2)
Pumping speed [1]	$m^3 \cdot h^{-1}$ (cfm)	40 (23.6)	40 (23.6)	65 (38.3)	65 (38.3)
Ultimate partial pr. without gas ballast [1]	mbar	$< 2.5 \cdot 10^{-1}$	$< 8 \cdot 10^{-4}$	$< 2.5 \cdot 10^{-1}$	$< 8 \cdot 10^{-4}$
	Torr	$< 1.9 \cdot 10^{-1}$	$< 6 \cdot 10^{-4}$	$< 1.9 \cdot 10^{-1}$	$< 6 \cdot 10^{-4}$
Ultimate total pressure w. gas ballast [1]	mbar	< 1	$< 5 \cdot 10^{-3}$	< 1	$< 5 \cdot 10^{-3}$
	Torr	< 0.75	$< 3.8 \cdot 10^{-3}$	< 0.75	$< 3.8 \cdot 10^{-3}$
Lubricant filling					
min./max.	l	2.0/3.0	1.5/2.5	1.5/2.5	2.0/3.5
upon delivery	l	0.7	0.6	0.75	0.75
Connections	DN	40 KF	40 KF	40 KF	40 KF
Motor protection	IP	54	54	54	54
Weight *	kg (lbs)	61 (134.5)	71 (156.6)	72 (158.8)	83 (183)
Motor power *	W	2200	2200	2200	2200
Noise level * to DIN 45 635, without/with gas ballast	dB (A)	57/59	57/59	57/59	57/59
TRIVAC BCS-PFPE with three-phase motor					
230/400 V, 50 Hz / 250/440 V, 60 Hz		**Cat. No. 103 89**	**Cat. No. 113 89**	**Cat. No. 103 99**	**Cat. No. 113 99**

1) To DIN 28 400 and subsequent numbers
* Length, weight, motor power and noise level for the models with three-phase motor.

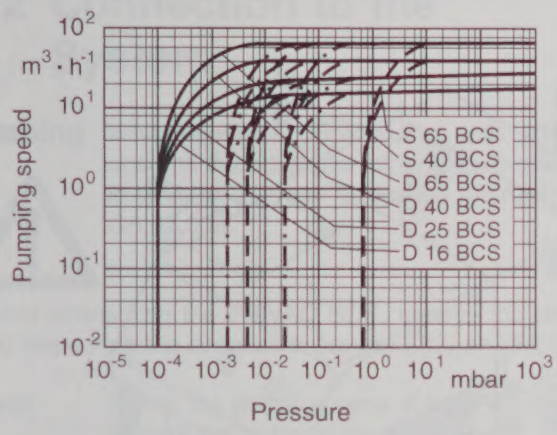
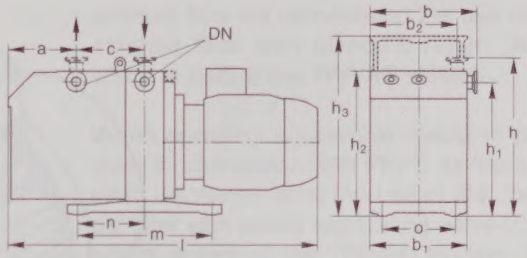


Fig. 5 Pumping speed characteristics for the TRIVAC BCS pumps (50 Hz operation, SI units)

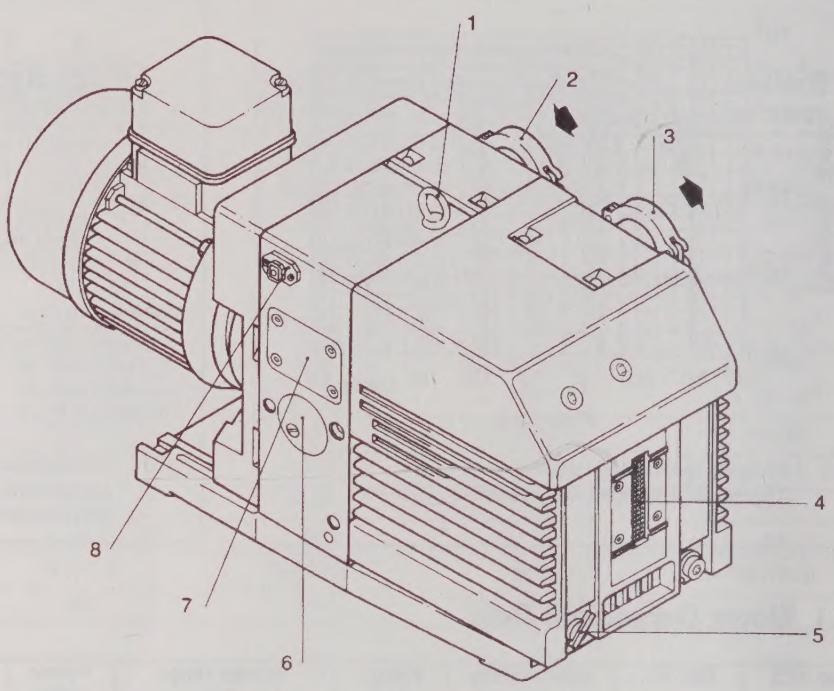


Model	DN	a	b	b1	b2	c	h	h1	h2	h3	l	m	n	o
S 40 BCS	40 KF	135	235	234	206	166	355	308	336	–	670	382	191	190
D 40 BCS	40 KF	135									670			
S 65 BCS	40 KF	135									670			
D 65 BCS	40 KF	213									750			

Fig. 6 Dimensional drawings for the TRIVAC BCS pumps (dimensions a, l, b to b_2 and h_1 are approximate, dimensions in mm) (1inch = 25.4 mm)

1.7.1 Motor Dependent Data

S 40 BCS	Ref. No.	Nom. voltage (V)	Frequ. (Hz)	Voltage range (V)	Power (kW)	Nom. current (A)	Size	Region
Cat. No. 103 88	380 66 011 3~	230/400 250/440	50 60	218-242/380-420 240-277/414-480	1.5	6.15/3.55 5.45/3.15	90	Euro (USA)
D 40 BCS	**Ref. No.**	**Nom. voltage (V)**	**Frequ. (Hz)**	**Voltage range (V)**	**Power (kW)**	**Nom. current (A)**	**Size**	**Region**
Cat. No. 113 88	380 66 011 3~	230/400 250/440	50 60	218-242/380-420 240-277/414-480	1.5	6.15/3.55 5.45/3.15	90	Euro (USA)
S 65 BCS	**Ref. No.**	**Nom. voltage (V)**	**Frequ. (Hz)**	**Voltage range (V)**	**Power (kW)**	**Nom. current (A)**	**Size**	**Region**
Cat. No. 103 98	380 66 012 3~	230/400 250/440	50 60	218-242/380-420 240-277/414-480	2.2	8.65/5.0 7.8/4.5	90	Euro (USA)
D 65 BCS	**Ref. No.**	**Nom. voltage (V)**	**Frequ. (Hz)**	**Voltage range (V)**	**Power (kW)**	**Nom. current (A)**	**Size**	**Region**
Cat. No. 113 98	380 66 012 3~	230/400 250/440	50 60	218-242/380-420 240-277/414-480	2.2	8.65/5.0 7.8/4.5	90	Euro (USA)
S 40 BCS-PFPE	**Ref. No.**	**Nom. voltage (V)**	**Frequ. (Hz)**	**Voltage range (V)**	**Power (kW)**	**Nom. current (A)**	**Size**	**Region**
Cat. No. 103 89	380 66 012 3~	230/400 250/440	50 60	218-242/380-420 240-277/414-480	2.2	8.65/5.0 7.8/4.5	90	Euro (USA)
D 40 BCS-PFPE	**Ref. No.**	**Nom. voltage (V)**	**Frequ. (Hz)**	**Voltage range (V)**	**Power (kW)**	**Nom. current (A)**	**Size**	**Region**
Cat. No. 113 89	380 66 012 3~	230/400 250/440	50 60	218-242/380-420 240-277/414-480	2.2	8.65/5.0 7.8/4.5	90	Euro (USA)
S 65 BCS-PFPE	**Ref. No.**	**Nom. voltage (V)**	**Frequ. (Hz)**	**Voltage range (V)**	**Power (kW)**	**Nom. current (A)**	**Size**	**Region**
Cat. No. 103 99	380 66 012 3~	230/400 250/440	50 60	218-242/380-420 240-277/414-480	2.2	8.65/5.0 7.8/4.5	90	Euro (USA)
D 65 BCS-PFPE	**Ref. No.**	**Nom. voltage (V)**	**Frequ. (Hz)**	**Voltage range (V)**	**Power (kW)**	**Nom. current (A)**	**Size**	**Region**
Cat. No. 113 99	380 66 012 3~	230/400 250/440	50 60	218-242/380-420 240-277/414-480	2.2	8.65/5.0 7.8/4.5	90	Euro (USA)
Cat. No. 113 97	200 10 412 3~	200/346 208/360	50 60	190-210/330-365 190-230/330-400	2.2	10,1/5,85 10,1/5,85	90	Japan, South and Central America (USA)



Key to Fig. 7
1 Eye bolt for moving the pump
2 Intake port
3 Exhaust port
4 Oil-level glass
5 Gas ballast knob
6 Cover plate, connection for IGS
7 Cover plate, connection for CFS
8 Connector for temperature switch

Fig. 7 Connections and controls

2 Operation

2.1 Installation

Warning The standard pump is not suited for installation in explosion hazard areas.
When planning such an application please contact us first.

The TRIVAC BCS pump can be set freely up on a flat, horizontal surface. Rubber feet under the coupling housing ensure that the pump can not slip.

Caution A fully assembled TRIVAC system D 65 must not be lifted at the eye bolt (7/1). First unscrew the eye bolt and fit an adaptor with a stronger eye bolt (Ref. No. 200 09 675).

If you wish firmly install the pump in place, insert bolts or similar through the bore holes in the rubber feet.

The rubber feet act as vibration absorbers. They must therefore not be compressed by bolts.

Caution When installing the TRIVAC BCS pump, make sure that the connections and controls are readily accessible.

Max. tilt for the pump (without further attachment) with possibly fitted standard accessories is 10° from the vertical.

The site chosen should allow adequate air circulation to cool the TRIVAC BCS (keep front and rear unobstructed). The ambient temperature should not exceed +40 °C (104 °F) and not drop below +12 °C (55 °F) (see Chapter 2.5.3).

The max. amount of heat given off approximately corresponds to the rated motor power.

2.2 Connection to the System

Warning When operating the pump with PFPE observe the additional information provided in Chapter 1.2 and Operating Instructions GA 07.009.

Before connecting the TRIVAC BCS, remove the shipping seals from the connection flanges (7/2) and (7/3).

Note Retain the shipping seals in case you need to store the pump in the future.

The pump is shipped with intake and exhaust flanges mounted for horizontal connection of the connecting lines. You can easily convert the ports for vertical connection by removing the four capscrews, rotating the flanges as required, and reinstalling the capscrews. Connect the intake and exhaust lines with a centering ring and a clamping ring each. Use the centering ring with dirt trap for the intake port.

Connect the intake and exhaust line using anti-vibration bellows, without placing any strain on the pump.

Caution The intake line must be clean. Deposits in the intake line may outgas and adversely affect the vacuum. The connecting flanges must be clean and undamaged.
The maximum throughput of the pump is equivalent to the pumping speed of the pump (see Chapter 1.6).
The cross-section of the intake and exhaust lines should be at least the same size as the connection ports of the pump. If the intake line is too narrow, it reduces the pumping speed. If the exhaust line is too narrow, overpressures may occur in the pump; this might damage the shaft seals and cause oil leaks. The maximum pressure in the oil case must not exceed 1.5 bar (absolute).

When pumping vapours, it is advisable to install condensate traps on the intake and exhaust sides.

Install the exhaust line with a **downward slope** (lower than the pump) so as to prevent condensate from flowing back into the pump. If this is not possible, insert a condensate trap.

Caution When oil mist is to be removed from the exhaust flow we recommend the use of the exhaust filter with lubricant return (ARS) which is part of the TRIVAC system.

When pumping aggressive media in particular in connection with PFPE as the lubricant, we recommend the use of the chemical filter with safety separating valve (CFS) which is part of the TRIVAC system. This will considerably extend the service life of the lubricant.

The inlet pressure for the gas ballast should be about 1000 mbar (absolute) and sufficient quantities of gas must be available (about $^1/_{10}$ of the pumping speed).

Warning Never operate the pump with a sealed exhaust line. There is the danger of injury.

Before starting any work on the pump, the personnel must be informed about possible dangers first. All safety regulations must be observed.
Depending on the type of application or the kind of pumped media, the corresponding regulations and information sheets must be observed.

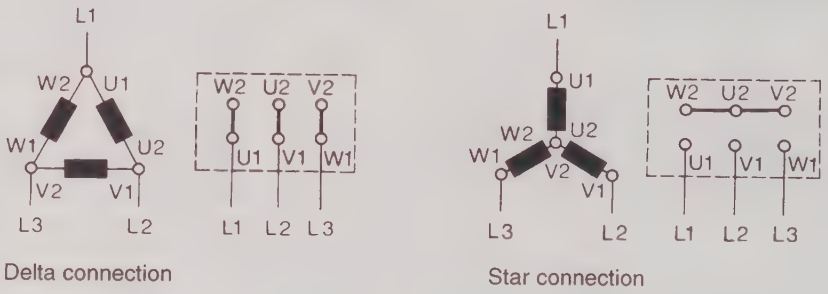


Fig. 8 Connection diagram for TRIVAC BCS with 50 Hz 3-phase motor

2.3 Electrical Connections

Warning Before beginning with any work on the wiring, ensure that mains supply for the pump is off.
Electrical connections must be done by a qualified electrician as defined by VDE 0105 in accordance with the VDE 0100 guidelines.

TRIVAC BCS pumps are supplied with three-phase motor but without accessories for electrical connection. They must be connected via the appropriate cable, and a suitable motor protection switch.

Set the switch in accordance with the rating on the motor nameplate.

Fig. 8 shows the connection for pumps with 230/380 V, 50 Hz motors. In the case of pumps equipped as standard with a 60 Hz motor, please observe the diagram on or at the motor.

Caution After connecting the motor and after every time you alter the wiring, check the direction of rotation. To do so, briefly switch on the motor and check whether a suitable cover (e. g. a blank flange) is sucked on at the intake port. If not, interchange two phases of the connection. Observe the direction arrow on the coupling housing.

If the connector for the temperature switch is not used, the plug may remain connected at this socket to protect it. However, there is the danger that the protruding plug may be damaged.

Caution The built-in temperature switch provides a signal when the pump gets too hot. We recommend that you access the signal available at this connector through the LSS and the EIS (see Chapter 1.6.2). Otherwise you may access the signal at pins 1 and 2 (voltage 24 V DC max., power consumption 10 W).

2.4 Start-up

Caution Each time before starting up check the oil level.

Warning Open all valves blocking the exhaust lines. The pump must never be operated with a blocked or constricted exhaust line.

For pumps with 3-phase motors, check the direction of rotation before starting the pump for the first time and after each change in the electrical connection (see Chapter 2.3).

On initial start-up, after prolonged idle periods or after an oil change, the specified ultimate pressure cannot be attained until the oil is degassed.

This can be done by running the pump for approx. 30 min. with the intake line closed and the gas ballast valve (7/5) open.

If the chemical filter (CFS) has been installed on the pump (see Chapter 1.6.2) the separating valve may be set to the position marked "Wechsel" during the first part of the run-up phase. When doing so, the relatively cold and thick lubricant will not have to be pumped through the interchangeable filter, thus removing some load from the pump's motor. Thereafter, the separating valve is set to the position "Betrieb".

Warning

Before starting the pump ensure that the pump and the fitted accessories meet the requirements of your application and that safe operation can be guaranteed.

Avoid exposure of any part of the body to the vacuum. There is the danger of injury. Never operate the pump with an open intake port. Vacuum connections as well as oil-fill and oil-drain openings must never be opened during operation.

The safety regulations which apply to the application in each case must be observed. This applies to installation, operation and during maintenance (service) as well as waste disposal and transportation.

The standard pump is not suited for pumping of hazardous gases or vapours.

Our technical sales department is available for further advice in these matters.

2.4.1 Areas of Application

Warning

The pump is not suitable for pumping of:

- ignitable and explosive gases or vapours
- oxidants
- pyrophorous gases.

Caution The pumps are not suitable for pumping of liquids or very dusty media. Suitable protective devices must be installed.

Our technical sales department is available for further advice in these matters.

2.4.2 Notes for Pumps with EExe II T3 Motors

There are no reservations as to operation of the vacuum pump in explosion hazard areas of outer ZONE 1 for substances of temperature classes T1 to T3 and explosion group IIA and IIB when observing the conditions given in the following:

Warning

- The electric motor of the vacuum pump must be connected through a suitable motor protection switch to the mains supply. If the vacuum pump is supplied ready for connection, the motor protection switch needs to be installed by the customer on the vacuum pump and within a pressure-tight encapsulation.

- The electric motor must be installed in accordance with the accepted rules which apply to electrical systems in explosion hazard areas. If required, detailed information on this is available from the manufacturer.

- In case of a failure relating to the vacuum, the vacuum pump must be switched off automatically by interrupting the power supply.

- Due to the measures introduced, the vacuum pump is **not** suited for pumping explosive atmospheres (inner explosion protection). If planning such an application please consult us first.

2.5 Operation

TRIVAC BCS pumps can pump condensable gases and vapours, provided that the gas ballast valve (7/5) is open and the pump has attained its operating temperature.

In connection with the inert gas system (IGS) which is part of the TRIVAC System, TRIVAC BCS pumps may be operated with an inert gas ballast.

Since the IGS is intended for a reduced gas ballast for purging the pump, the water vapour tolerance of the pump is reduced depending on the settings to values in the 1 mbar range.

The inert gas supply needs to be opened before allowing the process gas to enter into the pump.

2.5.1 Pumping of Non-Condensable Gases

If the process contains mainly permanent gases, the TRIVAC BCS may be operated without gas ballast, provided that the saturation vapour pressure at operating temperature is not exceeded during compression.

If the composition of the gases to be pumped is not known and if condensation in the pump cannot be ruled out, run the pump with the gas ballast valve open in accordance with Chapter 2.5.2.

2.5.2 Pumping of Condensable Gases and Vapours

With the gas ballast valve open and at operating temperature, TRIVAC BCS pumps can pump pure water vapour up to the water vapour tolerance specified by the technical data. If the vapour pressure increases above the permissible level, the water vapour will condense in the oil of the pump.

When pumping vapours ensure that the gas ballast valve is open and that the pump has warmed up for approximately 30 minutes with the intake line closed.

Caution Vapour phases may only be pumped up to the permissible limit after the pump has attained its operating temperature.

During pumping, vapours may dissolve in the oil. This changes the oil's properties and thus there is a risk of corrosion in the pump. Therefore, don't switch off the pump immediately after completion of the process. Instead, allow the TRIVAC BCS to continue operating with the gas ballast valve open and the intake line closed until the oil is free of condensed vapours.

We strongly recommend operating the pump in this mode for about 30 minutes after completion of the process.

In cyclic operation, the TRIVAC BCS should not be switched off during the intervals between the individual working phases (power consumption is minimal when the pump is operating at ultimate pressure), but should continue to run with gas ballast valve open and intake port closed (if possible via a valve).

Once all vapours have been pumped off from a process (e.g. during drying), the gas ballast valve can be closed to improve the attainable ultimate pressure.

2.5.3 Operating Temperature

Proper operation of the TRIVAC BCS is ensured in the ambient temperature range between 12 °C (55 °F) to 40 °C (104 °F).

Warning At operating temperature, the surface temperature of the oil case may lie between 40 °C (104 °F) and over 100 °C (212 °F), depending on the load.
There is the danger of receiving burns.

If – due to the ambient conditions – this temperature range is exceeded at either end of the range, then the operating range of the TRIVAC BCS can be adapted.

The Leybold sales department will be pleased to answer any questions in this matter.

2.6 Switching Off/ Shutdown

Since the TRIVAC BCS pump will commonly be exposed to aggressive and corrosive media, we recommend that you let the pump continue to operate even during long non-working intervals (e.g. overnight) with the intake line closed and the gas ballast valve open. This avoids corrosion during idle periods and difficulties when re-starting the pump under conditions where the lubricant has been chemically modified.

Caution When pumping condensable media let the pump continue to operate with the gas ballast valve open and the intake line closed before switching off (see Chapter 2.5.2). When using PFPE as the lubricant you must note the information given in Operating Instructions GA 07.009 when switching the pump off or shutting it down for a longer period of time.

If the TRIVAC BCS running with mineral oil is to be shutdown for an extended period after pumping aggressive or corrosive media or if the pump has to be stored, proceed as follows:

Warning When pumping harmful substances, take adequate safety precautions.

Our technical sales department is available for further advice in these matters.

Drain the oil (see Chapter 3.2).

Add clean oil until the oil-level is at the "min" mark (see Chapter 3.2) and let the pump operate for some time.

Then drain the oil and add clean oil until the oil level is at the "max." mark (see Chapter 3.2).

Seal the connection ports. Special conservation or anti-corrosion oils aren't necessary.

Caution Please also take note of the information given in Chapter 3.9 (Storing the Pump).

2.6.1 Shutdown through Monitoring Components

Warning When the pump has been switched off due to overheating sensed by the motor coil protector, the pump must only be started manually after the pump has cooled down to the ambient temperature and after having removed the cause first.

2.6.2 Failure of the Control System or the Mains Power

Warning In order to prevent the pump from running up unexpectedly after a mains power failure, the pump must be integrated in the control system in such a way that the pump can only be switched on again manually. This applies equally to emergency cut-out arrangements.

3 Maintenance

Warning Disconnect the electrical connections before disassembling the pump. Make absolutely sure that the pump cannot be accidentally started.

If the pump has pumped harmful substances, ascertain the nature of hazard and take adequate safety measures.
Observe all safety regulations.

If you send a pump to LEYBOLD for repair please observe the information provided in Chapter 3.8.

Caution When using PFPE as the lubricant please observe all instructions given in Chapter 1.2 and in Operating Instructions GA 07.009.
When disposing of used oil, you must observe the applicable environmental regulations!

Due to the design concept, TRIVAC BCS pumps require very little maintenance when operated under normal conditions. The work required is described in the sections below.

Caution All work must be carried out by suitably trained personnel. Maintenance or repairs carried out incorrectly will affect the life and performance of the pump and may cause problems when filing warranty claims.

LEYBOLD offers practical courses on the maintenance, repair, and testing of TRIVAC BCS pumps. Further details are available from LEYBOLD on request.

Caution If the TRIVAC BCS is used in ambient air which is much contaminated, make sure that the air circulation and the gas ballast valve are not adversely affected.

When the TRIVAC BCS has been pumping corrosive media we recommend that possibly planned maintenance work be carried out immediately in order to prevent corrosion of the pump while it is at standstill.

For spare parts numbers please refer to the enclosed Spare Parts List.
In the case of custom models and special versions, please always state the number of the custom model or version together with its serial number.

3.1 Checking the Oil Level

During operation of the TRIVAC BCS the oil level must always remain between marks (9/2) and (9/3) at the oil-level glass. The amount of oil must be checked and topped up as required.

Caution Fill in oil only after the pump has been switched off.

When operating the TRIVAC BCS in connection with the exhaust filter with lubricant return (ARS 40-65) the checking intervals are extended (see Chapter 1.6.2).

When using the oil float switch (LSS) remote monitoring of the lubricant is possible (see Chapter 1.6.2).

When properly used, PFPE is not subject to any wear. Thus it will not be required to exchange the PFPE lubricant. Possible contamination is filtered out by the chemical filter (CFS). The lubricant becomes turbid when contaminated. You must exchange the filter in such a case.

3.1.1 Checking the Condition of N 62 or HE 200 Oil

a) Visual check

Normally the oil is clear and transparent. If the oil darkens, it should be changed.

b) Chemical check

The neutralisation number of N 62 oil is determined according to DIN 51558. If it exceeds 2, the oil should be changed.

c) Viscosity check

If the viscosity of N 62 oil at 25 °C exceeds 300 mPas, the oil should be changed.

If gases or liquids dissolved in the oil result in a deterioration of the ultimate pressure, the oil can be degassed by allowing the pump to run for approx. 30 min. with the intake port closed and the gas ballast valve open.

When wanting to check the oil, switch off the pump first and drain out from the warm pump the required amount of oil through the oil drain (9/4) into a beaker or similar.

Note Please note the safety information given in Chapter 3.2.

3.2 Oil Change

(not required for PFPE)

Warning Hazardous substances may escape from the pump and the oil. Take adequate safety precautions. For example wear gloves, face protection or breathing protection.
Observe all safety regulations.

For proper operation of the pump, it is essential that the pump has an adequate supply of the correct and clean oil at all times.

The oil must be changed when it looks dirty or if it appears chemically or mechanically worn out (see Chapter 3.1.1).

The oil should be changed after the first 100 operating hours and then at least every 2,000 to 3,000 operating hours or after one year. At high intake pressures and intake temperatures and/or when pumping contaminated gases, the oil will have to be changed more frequently.

Further oil changes should be made before and after long-term storage of the pump.

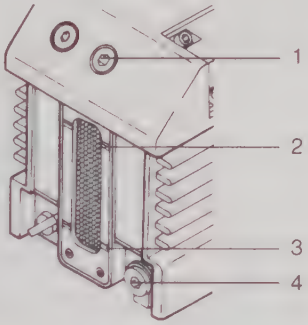
If the oil becomes contaminated too quickly, install a dust filter and/or oil filter (see Chapter 1.6).

Contact us for more information in this matter.

Required tool:
Allen key size 8.

Caution Only change the oil after the pump has been switched off and while the pump is still warm.

Warning If there is the danger that the operating agent may present a hazard in any way due to decomposition of the oil, or because of the media which have been pumped, you must determine the kind of hazard and ensure that all necessary safety precautions are taken.



Key to Fig. 9
1 Oil-fill plug
2 Oil-level mark "maximum"
3 Oil-level mark "minimum"
4 Oil-drain plug

Fig. 9 Oil change

Remove the oil-drain plug (9/4) and let the used oil drain into a suitable container. When the flow of oil slows down, screw the oil-drain plug back in, briefly switch on the pump (max. 10 s) and then switch it off again. Remove the oil-drain plug once more and drain out the remaining oil.

Screw the oil-drain plug back in (check the gasket and reinstall a new one if necessary).

Remove the oil-fill plug (9/1) and fill in fresh oil.

Screw the oil-fill plug (9/1) back in.

When an exhaust filter with lubricant return has been installed on the pump (see Chapter 1.6.2) please also exchange the oil there.

Caution We can only guarantee that the pump operates as specified by the technical data if the lubricants recommended by us are used.

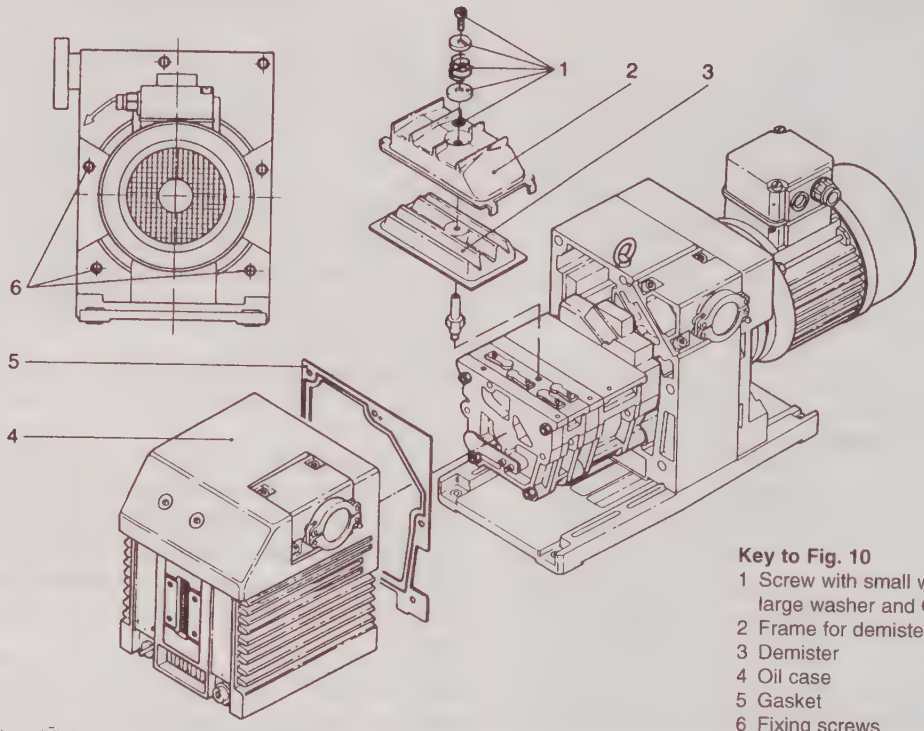
3.3 Cleaning the Dirt Trap

A wire-mesh sieve is located in the intake port of the pump to act as a dirt trap for foreign objects. It should be kept clean to avoid a reduction of the pumping speed.

For this purpose, remove the dirt trap (2/2) from the intake port and rinse it in a suitable vessel with solvent. Then thoroughly dry it with compressed air.

If the dirt trap is defective, replace it with a new one.

Caution The cleaning intervals depend on the application. If the pump is exposed to large amounts of abrasive materials, a dust filter should be fitted into the intake line.



Key to Fig. 10
1 Screw with small washer, spring, large washer and O-ring
2 Frame for demister
3 Demister
4 Oil case
5 Gasket
6 Fixing screws

Fig. 10 Removal and fitting of the internal demister

3.4 Removing and Fitting the Internal Demister

(not required for PFPE)

Required tools:
Allen keys size 6 and 8

Required spare parts:
Gasket for oil case 200 09 148
Internal demister: 390 26 014

The internal demister is spring-mounted in a frame. When it is clogged, it rises periodically to reduce the pressure difference created. The resultant noise at high intake pressures indicates that the internal demister is dirty.

Periodically clean or replace the internal demister; the maintenance interval depends on the application. Use a suitable solvent for cleaning.

Shutdown the pump and drain the oil (see Chapter 3.2).

Remove the **six recessed** screws (10/6) on the oil case (10/4). Don't remove the **non-recessed screws**; they hold the motor flange in place and need not be removed.

Pull the oil case forward off the pump.

Remove the gasket (10/5).

Unscrew screw (10/1).

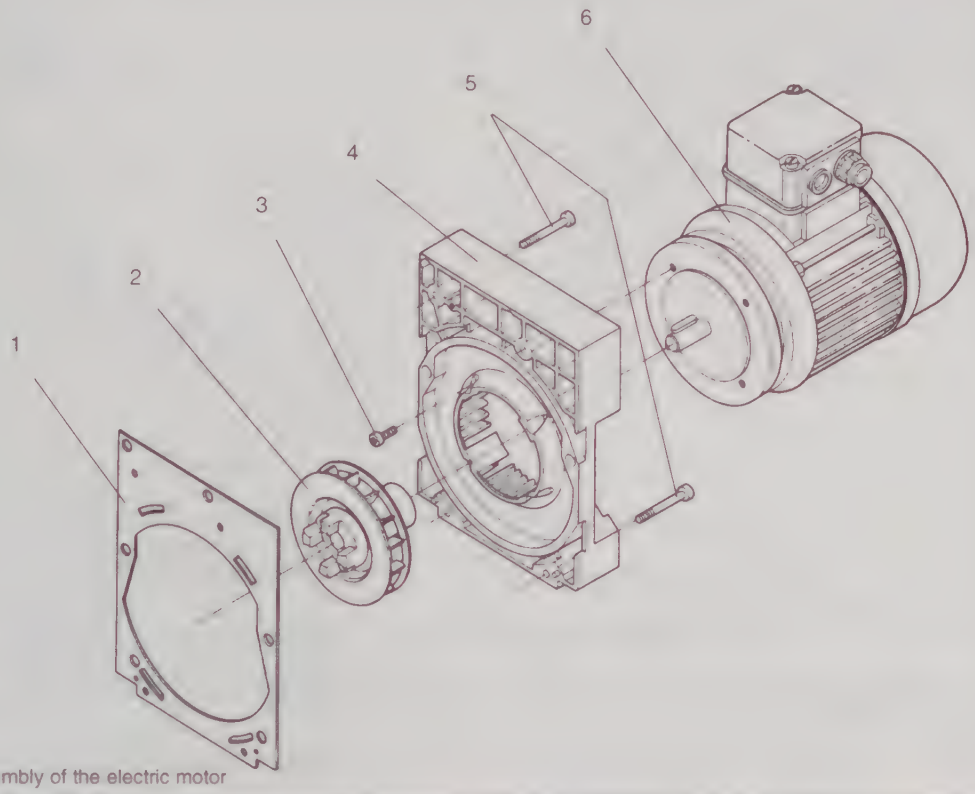
Remove small washer (10/1), spring (10/1), large washer (10/1) and O-ring (10/1).

Lift off the frame (10/2) and remove the internal demister (10/3).

Clean all parts and check that they are in perfect condition; if not, replace them with new parts.

Reassemble in the reverse order.

Torque for the screws (10/6) is 12 Nm.



Key to Fig. 11
1 Gasket
2 Coupling with fan blades
3 Hex. socket screws
4 Intermediate flange
5 Hex. socket screws
6 Electric motor

Fig. 11 Disassembly and reassembly of the electric motor

3.5 Disassembly and Reassembly of the Electric Motor

Warning Before starting any disassembly work, always disconnect the motor from the mains.
Reliably prevent the pump from running up.

Required tools:

Screwdriver 1.0 x 5.5 mm (for junction box), open-jaw wrenches size 7 and size 19 (for junction box), Allan keys size 3 and size 6.

Possibly a puller for the coupling.

Disconnect the mains connection.

Support the motor.

Unscrew the four **non-recessed** hex. socket screws (11/5).

Remove the intermediate flange (11/4) together with the electric motor.

Remove the gasket (11/1).

Loosen the threaded pin and pull the coupling with the blade wheel (11/2) off the motor shaft.

Unscrew the hex. socket screws (11/3).

Remove the electric motor (11/6).

Clean all parts and check that they are in perfect condition; if not, replace them with new parts.

Reassemble in the reverse order.

Key to Fig. 12

1 Coupling element
2 Cylinder head screw
3 Spring washer
4 Coupling (one half)
5 Key
6 Compression ring
7 O-ring
8 Holding plate
9 Shaft seals
10 Centering disk
11 O-ring
12 Bushing
13 Bolts

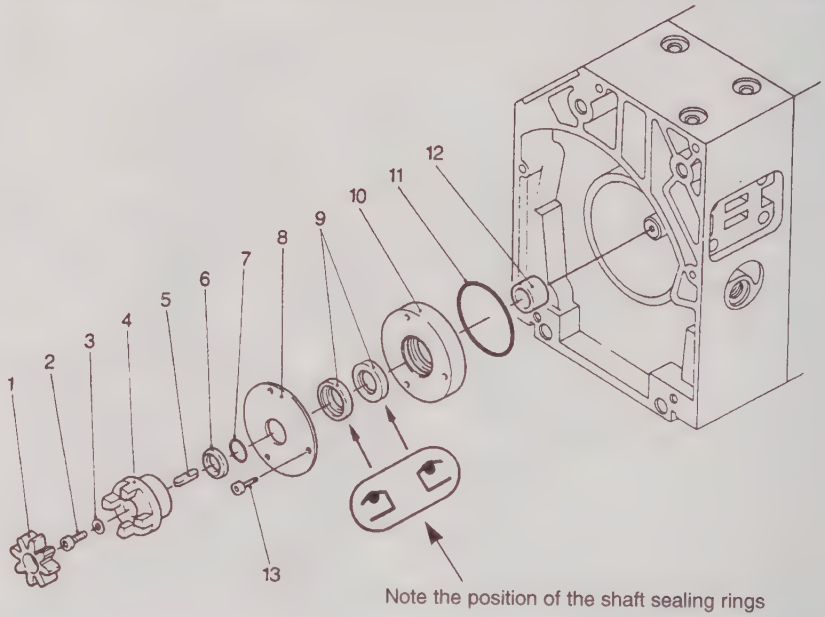


Fig. 12 Exchanging the shaft seal

3.6 Replacing the Outer Shaft Seal

Note Oil stains under the housing of the coupling indicate a worn shaft sealing ring.
The shaft sealing ring may be exchanged without having to remove or disassemble the pump module.

Required tools:

Allen keys size 3, 5 and 8, flat-nose pliers, plastic hammer, shaft seal driver, possibly a puller for the coupling.

Required spare parts:

Shaft seal 239 53 007
Bushing 231 92 034

Shutdown the pump.

Drain the oil (see Chapter 3.2).

Support the motor.

Unscrew the four **non-recessed** hex. socket screws (11/5) and remove the motor (11/6) with the intermediate flange.

Remove gasket (11/1).

Remove coupling element (12/1).

Unscrew screw (12/2) and pull off the spring washer (12/3).

Pull off the coupling half (12/4).

Remove key (12/5).

Pull off the compression ring (12/6) and O-ring (12/7).

Unscrew the hex. socket screws (12/13) and pull out the centering disc (12/8).

Pull the centering disk (10/12) out.

If the centering disc does not come loose, use the forcing thread into which screws (12/13) can be screwed in.

Remove the O-ring (12/11).

Force the shaft seal (12/9) out of the centering disk.

Pull off the bushing (12/12) from the shaft.

Note We recommend the use of a new shaft seal and bushing for reassembly.
Before fitting the new shaft seal, moisten it slightly with a little vacuum pump oil.

Key to Fig. 13
left: driver for the inner sealing ring
right: driver for the outer sealing ring
bottom: centering disk with shaft sealing ring

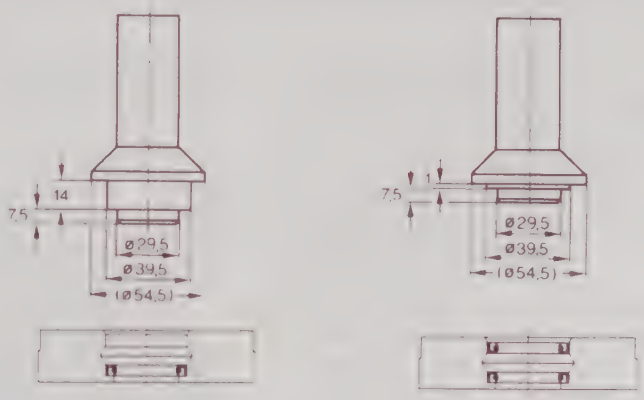


Fig. 13 Shaft sealing ring driver

Using a suitable plastic or aluminium cylinder (shaft seal driver) and a plastic hammer, force the shaft seal (12/9) carefully and without bending it into the centering disk (for position of shaft seal, see Fig. 12).

If you do not have a shaft seal driver, place the shaft seal on the centering disk and carefully force it in with light blows of the plastic hammer.

The shaft seal must not be bent.

Insert the O-ring (12/11) into its groove.

Carefully push the centering disk (12/10) with the shaft seal onto the shaft and up against the end plate.

Push the holding panel (12/8) on and tighten with bolts (12/13).

Insert the busing (12/12) carefully at the center of the centering disk.

Push the O-ring (12/7) and the compression disk (12/6) on to the shaft.

Insert the key (12/5).

Mount the pump-half of the coupling (12/4) on the shaft.

Install the spring washer (12/3) and tighten the screw (12/2).

Insert the coupling element (12/1) into the coupling and mount the motor (see Chapter 3.5).

3.7 Removing and Remounting the Pump Module

Required tools:

Allen keys size 3, 4, 6 and 8 mm, box wrench size 13, possibly pliers, torque wrench.

Required spare parts:
Gaskets: 239 73 039
. . . . . 200 90 148

3.7.1 Removing the Pump Module

Drain the oil and remove the oil case (see Chapter 3.4).

Unscrew the hex. nuts (14/1).

Pull the entire pump module (14/2) forward off the tie rods (14/5).

Caution When doing so, ensure that the individual pin-fitted parts are not loosened. Further disassembly of the pump module should only be carried out by a trained service engineer.

Remove the gasket (14/3).

Remove the coupling element (14/4).

Caution After removing the protective shipping materials, handle the new pump module with care.

Before installing a new pump module, remove the four tie rods from the new module and insert them in the old one for protection during shipment.

Key to Fig. 14
1 Hex. nuts
2 Pump module
4 Gasket
5 Coupling element
6 Tie rods

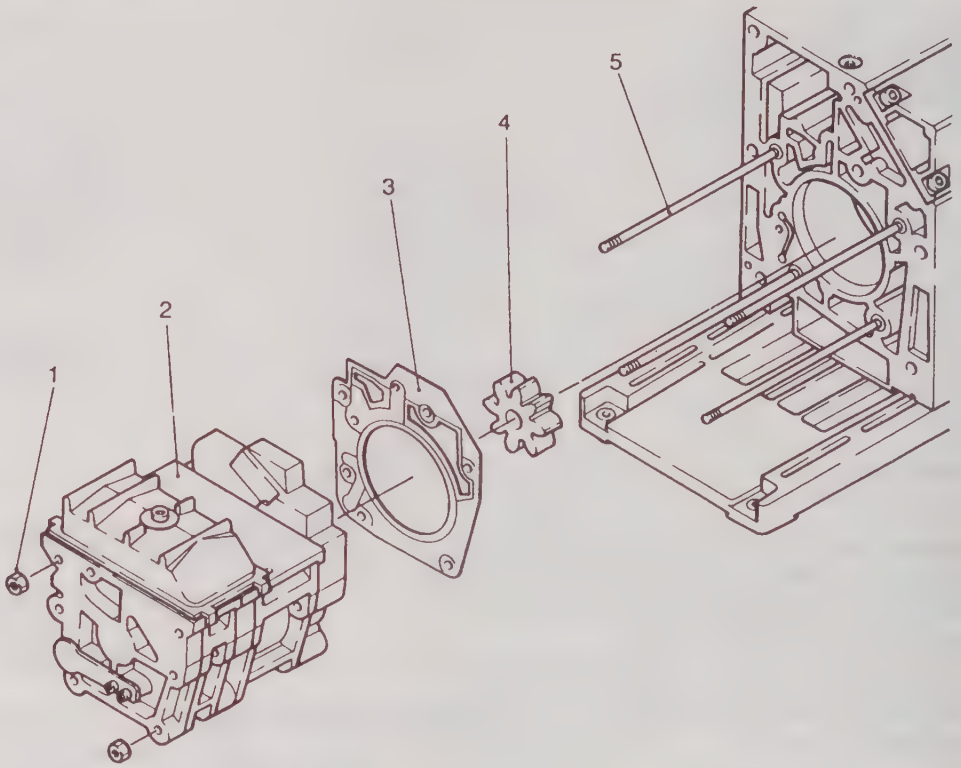


Fig. 14 Removing and remounting the pump module

3.7.2 Remounting the Pump Module

When installing a new pump module, it is also advisable to use a new gasket (14/3).

Check the coupling element (14/4) for damage; if necessary, install a new one.

Use the tie rods supplied with the new pump module only if the old ones are damaged. To do so, unscrew the old tie rods with lock nuts, and screw in the new ones. With the aid of the lock nuts, tighten the tie rods. Then remove the lock nuts.

Push the gasket (14/3) onto the tie rods (14/5), push the coupling element (14/4) onto one coupling half.

Push the entire pump module (new or repaired) onto the tie rods.

Screw on the hex. nuts (14/1) and carefully cross-tighten them (torque 17 Nm).

Mount the oil case together with the gasket (see Chapter 3.4).

Fill in oil.

3.8 Leybold Service

If a pump is returned to Leybold, indicate whether the pump free of substances damaging to health or whether it is contaminated. If it is contaminated also indicate the nature of the hazard. For this you must use a form which has been prepared by us which we will provide upon request.

A copy of this form is reproduced at the end of these Operating Instructions: "Declaration of Contamination of Vacuum Instruments and Components".

Please attach this form to the pump or enclose it with the pump.

This "Declaration of Contamination" is required to meet German Law and to protect our personnel.

Leybold must return any pumps without a "Declaration of Contamination" to the sender's address.

Warning The pump must be packed in such a way, that it will not be damaged during shipping and so that any contaminants are not released from the package.

3.8.1 Waste Disposal of Used Pump Materials

The corresponding environmental and safety regulations apply. This applies equally to used filters and filter elements (oil filter, exhaust filter and dust filter).

Warning – In the case of hazardous substances determine the kind of hazard first and observe the applicable safety regulations. If the potential hazard still persists, the pump must be decontaminated before starting with any maintenance work. For professional decontamination we recommend our Leybold service.

– Never exchange the oil or the filters while the pump is still warm. Let the pump cool down to uncritical temperatures first. You must wear suitable protective clothing.

3.9 Storing the Pump

Caution Before putting a pump into operation once more it should be stored in a dry place preferably at room temperature (20 °C = 68 °F). Before the pump is shelved it must be properly disconnected from the vacuum system, purged with dry nitrogen and the oil should be changed too.

The inlets and outlets of the pump must be sealed with the shipping seals which are provided upon delivery.
The gas ballast switch must be set to the "0" position and if the pump is to be shelved for a longer period of time it should be sealed in a PE bag containing some desiccant (silica gel).

When a pump is put into operation after it has been shelved for over one year, standard maintenance should be run on the pump and the oil should also be exchanged (see Operating Instructions). We recommend that you contact the Leybold service.

3.10 Maintenance Plan (Recommendation)

No.	Rotary vane pumps TRIVAC S/D 40 BCS TRIVAC S/D 65 BCS	Measurement/test quantity Operating/auxiliary materials	Interval						Remarks
			VE	VP	t	6m	a	n-a	Refer also to the Operating Instructions – Chapter: individual components.
1	Operate the pump for at least 0.8 hours with gas ballast.				x				Condensed water is thus removed from the oil.
2	Check the oil level, change the oil if required.	Oil: N 62 or special alternative oils (see Chapter 1.6.1)	x		x				Refill: only after the pump has been switched off.
3	Check the quality of the oil, change the oil if required.	visually	x		x				**Visually:** normally light and transparent, oil change is required when discolorations increase.
		chemically				x			**Chemically:** to DIN 51558 when the neutralisation number exceeds 2; then an oil change will be required.
		mechanically				x			**Mechanically:** when dynamic viscosity at 25 °C exceeds 300 mPas; then an oil change will be required. Disposal of waste oil: see Chapter 3.8.1.
4	Clean the dirt trap in the intake port, change it as required.	Suitable cleaning agent and compressed air.				x			❑ Clean dirt trap with a cleaning agent and blow it out with compressed air under a suction hood. ❑ Replace the defective dirt trap. Use a cleaning agent which complies with the national / international specifications. **Observe the safety regulations when using cleaning agents.**
5	Clean the internal demister, change it as required.	Suitable cleaning agent.					x		Already clean before the maintenance interval has elapsed when the noise level increases. ❑ Clean the internal demister using a cleaning agent. ❑ Replace the defective internal demister. ❑ Dispose of the defective internal demister as special waste. Cleaning agent according to national / international specifications. **Observe the safety regulations when using cleaning agents.**
6	Check the edges of the teeth on the coupling element for any damages, change the coupling element as required.						x		

No.	Rotary vane pumps TRIVAC S/D 40 BCS TRIVAC S/D 65 BCS	Measurement/test quantity Operating/auxiliary materials	Interval						Remarks
			VE	VP	t	6m	a	n-a	Refer also to the Operating Instructions - Chapter: individual components.
7	Change the oil - and clean the oil level glass	Oil: N 62 or special and alternative oils. Suitable cleaning agent and compressed air.					x		Oil change: • First oil change after 100 operating hours. • Pump switched off and cold. Change the oil when the pump is cold in order to avoid releasing absorbed gases. ⌟ Clean the oil level glass with a cleaning agent and blow it out with compressed air under a suction hood. Cleaning agent according to national / international specifications. **Observe the safety regulations when using cleaning agents.** **Quantity of oil:** see Operating Instructions, Chapter 1.7. **Waste disposal of oil:** see Operating Instructions, Chapter 3.8.1.
8	Check the fan of the pump and the motor as well as the cooling fins on the motor for deposits and clean as required.	Brush and industrial vacuum cleaner.					x		Already clean before the maintenance interval has elapsed when the pump or the motor gets too warm. **Caution:** switch off the pump and ensure that it can not run up inadvertently (disconnect from the mains).

Key to the maintenance plan

VE = Maintenance before switching on the system
VP = Maintenance before starting production
t = Daily maintenance
w = Weekly maintenance
2w = Maintenance every two weeks
m = Monthly maintenance
3m = Three monthly maintenance
6m = Six monthly maintenance
a = Annual maintenance
n-a = Maintenance every n years

We recommend that you service the pump every two years covering the following:

- Cleaning
- Checking of the individual components
- Exchange of all seals
- Functional check.

This check should be run by the Leybold service.

4 Troubleshooting

Fault	Possible cause	Remedy	Repair*
Pump does not start.	Wiring is malfunctioning.	Check and repair wiring.	-
	Motor protection switch incorrectly set (3-phase motors only).	Set motor protection switch properly.	2.3
	Operating voltage does not match motor.	Replace the motor.	3.5
	Motor is malfunctioning.	Replace the motor.	3.5
	Oil temperature is below 12 °C.	Heat the pump and pump oil or use different oil.	2.5.3/3.2
	Oil is too viscous.	Change the oil.	3.2
	Exhaust filter or exhaust line is clogged.	Replace the filter or clean the exhaust line.	-
	Pump is seized up (sign: pump is jammed).	Repair the pump.	Service
Pump does not reach ultimate pressure.	Measuring technique or gauge is unsuitable.	Use correct measuring technique and gauge. Measure the pressure directly at pump's intake port.	-
	External leak[1].	Repair the pump.	Service
	Anti-suckback valve is malfunctioning.	Repair the valve.	Service
	Exhaust valve is malfunctioning.	Repair the valve.	Service
	Oil is unsuitable.	Change the oil (degas it, if necessary).	3.2
	Intake line is dirty.	Clean vacuum lines.	-
	Pump is too small.	Check the process data; replace the pump, if necessary.	-
Pumping speed is too low.	Dirt trap in the intake port is clogged.	Clean the dirt trap; Precaution: install a dust filter in intake line.	3.3
	Exhaust filter is clogged.	Exchange the filter element.	-
	Connecting lines are too narrow or too long.	Use adequately wide and short connecting lines.	2.2
After switching off pump under vacuum, pressure in system rises too fast.	System has a leak.	Check the system.	-
	Anti-suckback valve is malfunctioning.	Repair the valve.	Service
Pump gets hotter than usually observed.	Cooling air supply is obstructed.	Set pump up correctly.	2.1
	Ambient temperature is too high.	Set pump up correctly.	2.1/2.5.3
	Process gas is too hot.	Change the process.	-
	Oil level is too low.	Add oil.	3.2
	Oil is unsuitable.	Change the oil.	3.2
	Oil cycle is obstructed.	Clean or repair the oil lines and channels.	Service
	Exhaust filter or exhaust line is obstructed.	Replace the exhaust filter, clean the exhaust line.	-
	Exhaust valve is malfunctioning.	Repair the valve.	Service
	Pump module is worn out.	Replace the pump module.	3.7
Oil in the intake line or in vacuum vessel.	Oil comes from the vacuum system.	Check the vacuum system.	-
	Anti-suckback valve is obstructed.	Clean or repair the valve.	Service
	Sealing surfaces of anti-suckback valve are damaged or dirty.	Clean or repair the intake port and the anti-suckback valve.	Service
	Oil level is too high.	Drain the excess oil.	3.2
Oil is turbid.	Condensation.	Degas the oil or change the oil and clean the pump. Precaution: open the gas ballast valve or insert a condensate trap.	2.5.2/3.2
Pump is excessively noisy.	Oil level is much too low (oil is no longer visible).	Add oil.	3.2
	Silencing nozzle is clogged.	Clean or replace the silencing nozzle.	Service
	Intake pressure is too high.	Lower the intake pressure.	-
	Internal demister is clogged.	Clean or replace demister.	3.4
	Coupling element is worn.	Install new coupling element.	3.5
	Vanes or bearings are damaged.	Repair pump.	Service

* Repair information: refer to the Chapter in the Operation Instruction stated here.

1) Bubble test: the warm pump with degassed oil is running without gas ballast and the intake blanked off. The exhaust line is led in to a vessel with water. If an evenly spaced line of bubbles appears, then the pump has an external leak.

EC Declaration of Conformity

We – LEYBOLD VACUUM GmbH – herewith declare that the products defined below meet the basic requirements regarding safety and health of the relevant EC directives by design, type and versions which are brought into circulation by us.

In case of any product changes made without our approval, this declaration will be void.

Designation of the products:	Rotary vane pump single and dual stage
Types: TRIVAC BCS;	S/D 40 BCS; S/D 65 BCS
Cat. Nos.:	103 88; 103 98 113 88; 113 98 103 89; 103 99 113 89; 113 99 113 97

The products conform to the following directives:

- EC Directive on Machinery (89/392/EWG) and subsequent 91/368/EWG
- EC Directive on Low-Voltages (73/23/EWG)
- EC EMI Directive (89/336/EWG)

Applied harmonised standards:

• EN 292 Part 1 and Part 2	Nov. 1991
• pr. EN 1012 Part	1993
• EN 60 204	1993

Applied national standards and technical specifications:

• DIN 31 001	April 1983

Cologne, June 5, 1996

Plingen, Business Area Manager
Forevacuum pumps

Cologne, June 5, 1996

Frings, Design Department Manager
Forevacuum pumps

LEYBOLD

VDMA

Declaration of Contamination of Vacuum Equipment and Components

The repair and/or service of vacuum equipment and components will only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay. The manufacturer could refuse to accept any equipment without a declaration.
This declaration can only be completed and signed by authorized and qualified staff.

1. Description of Vacuum Equipment and Components

- Equipment type/model: _____
- Code No.: _____
- Serial No.: _____
- Invoice No.: _____
- Delivery date: _____

2. Reason for Return

_____
_____
_____
_____
_____
_____

3. Condition of the Vacuum Equipment and Components

- Has the equipment been used?
  yes ❒ no ❒
- What type of pump oil/liquid was used? _____
- Is the equipment free from potentially harmful substances?
  yes ❒ (go to Section 5)
  no ❒ (go to Section 4)

4. Process related Contamination of Vacuum Equipment and Components:

- toxic	yes ❒	no ❒
- corrosive	yes ❒	no ❒
- explosive*)	yes ❒	no ❒
- biological hazard*)	yes ❒	no ❒
- radioactive*)	yes ❒	no ❒
- other harmful substances	yes ❒	no ❒

*) Vacuum equipment and components which have been contaminated by biological explosive or radioactive substances, will not accepted without written evidence of decontamination!

Please list all substances, gases and by-products which may have come into contact with the equipment:

Trade name Product name Manufacturer	Chemical name (or Symbol)	Dangerous material class	Measures if spillage	First aid in case of human contact
1.				
2.				
3.				
4.				
5.				

5. Legally Binding Declaration

I hereby declare that the information supplied on this form is complete and accurate. The despatch of the contaminated vacuum equipment and components will be in accordance with the appropriate regulations covering Packaging, Transportation and Labelling of Dangerous Substances.

Name of organisation or company: _____

Address: _____ Post code: _____

Tel.: _____

Fax: _____ Telex: _____

Name: _____

Job title: _____

Date: _____ Company stamp:

Legally binding signature: _____

SAMPLE

Copies: Page 1 (white) to manufacturer or representative - Page 2 (yellow) attach to consignment packaging securely - Page 3 (blue) copy for file of sender

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